

authority on the question of steel manufacture, replied that the pig in his district only contained  $1\frac{1}{2}$  to  $1\frac{3}{4}$  per cent. of phosphorus; but the real difficulty was not affected by the quantity of phosphorus, it being easy to get rid of large quantities of the impurity, whereas the real difficulty occurs in removing the last trace of it.

Whether this view be correct or not will soon be proved. The Admiralty regulations will give basic steel a fair trial, and if steel-makers can succeed in regularly producing an article which will satisfy the Admiralty, its use must in time extend to the Mercantile Marine.

## ADMIRALTY SURVEYS.

**T**HE following is an abstract of the most important parts of the Hydrographer's "Report on Admiralty Surveys," recently published as a Parliamentary Paper. These surveys were made during the year 1891.

Ten ships were engaged on hydrographical surveys at home and abroad, and with regard to these surveys the Hydrographer significantly remarks that—

"During the year 1891 the Hydrographic Department has received information of 121 new dangers of the most formidable class, viz., *small submerged rocky patches which are difficult to find*. Of these, 81 rocks were reported by H.M. surveying vessels; 10 rocks by other of H.M. ships; 14 by various British and foreign vessels; 22 were brought to light by vessels striking on them; and 42 were reported by colonial and foreign Governments. The fact that a new rock was found in the area traversed by a large part of the enormous trade of Liverpool is a convincing proof, if one were needed, of the difficulty of feeling certain that all hidden rocks have been brought to light, even in surveyed and much-navigated waters."

The Report then proceeds to record, in detail, the work done by the various surveying vessels:—

"*England, South Coast; Ireland, North Coast; Scotland, West Coast.*  
—H.M.S. *Research*, Captain Hon. Foley C. P. Vereker, determined, off Ventnor, a running distance in deep water for steam trials of deep-draught swift ships. A re-examination of the Shingles Bank in the Needles Channel was next undertaken; much alteration was here found to have taken place since the last Admiralty survey in 1881, the bank having extended southward and westward. Proceeding to Brownsea

Road, Poole Harbour, a re-examination of the Swash Channel and bar leading into the harbour, showed that a good deal of alteration had taken place since 1878, when previously sounded.

"The *Research* next proceeded to Exmouth, and there continued the survey of the mouth of the River Exe; subsequently sailing for the north coast of Ireland for the purpose of obtaining more accurate off-shore soundings in the approach to the northern shores of Ireland. Finally a new survey of Oban Bay and its approaches, on 10 ins. to the nautical mile, was made.

"*England, East Coast.*—H.M.S. *Triton*, commanded by Staff-Captain T. H. Tizard, began surveying operations on the estuary of the Thames, and made a re-examination of the Duke of Edinburgh Channel in consequence of shoaler water having been found on the Shingles Patch in October, 1890. The result proved that the Shingles Patch was still increasing in size, its extent being within the five fathoms line, a little over one mile in length and four cables in breadth, the least depth on the patch was 19 ft., precisely what it was in October, 1890. Opportunity was also taken to examine the Tongue Knoll, and the east end of Margate Sand. Both were found to extend considerably farther east than when last surveyed, necessitating a re-arrangement of the buoyage and an alteration in the red arc of the North Foreland Lighthouse.

"Shortly afterwards the vessel proceeded to the River Tyne. Here a survey on 10 ins. to the nautical mile was executed of that part of the river from Howden seaward to three-quarters of a mile eastward of the entrance. The breakwaters are approaching completion, and their success is very apparent when it is considered that the bar of this river, which used only to carry six ft. of water, has now a depth of over 30 ft. at low tide.

"Making a survey of the River Tees, on 10 ins. to the nautical mile, it was found that the outer bar of the Tees carries a least depth of 16 ft. at low water, that a depth of 10 ft. at low water could be carried up to Middlesbrough, that the shoal water off the north entrance point had extended considerably, and that a bank had been formed off it with a depth of 13 ft. at low water.

"From the Tees the *Triton* proceeded to the Wash, and surveyed Freeman Channel, a passage recently widened through the sands between Boston and Lynn deeps. A depth of 10 ft. at low water was found in this channel, which is now buoyed and lighted. Boston bar was found to have altered its direction completely, trending more to the southward over a place where formerly the sand dried at low water. The new channel across the bar is more tortuous and narrow than the former passage, and has no greater depth in it than 10 ft. at low water.

"*Scotland, West Coast; Wales.*—The *Knight Errant*, a hired steam-vessel, under the command of Staff-Commander W. E. Archdeacon, commenced surveying operations on the West Coast of Scotland, making a very close survey of Lamlash Harbour in Arran Island, and also of

Campbellton Loch on the east side of the peninsula of Cantyre, Argyllshire. Lamlash has of late years been resorted to by large squadrons of H.M. ships, and it was therefore desirable to define the limits of anchorage for large ships with accuracy. The survey was therefore carried out on a large scale, and the results showed that the work had not been undertaken too soon, as in the harbour itself not only had the northern part shallowed, but a pinnacle rock with 88 ft. over it and 10 to 15 fathoms close round it, unknown even to local fishermen, was discovered in the middle of the anchorage.

"Off Holy Island an extensive gravel bank was found to extend nearly half a mile from its south point, with several coralline knobs on it, having 28 to 31 ft. over them. Other, but deeper, rocky patches were discovered on the east side of Holy Island.

"Commenced a very close survey on a large scale of the Skerries Channel and north coast of Anglesea from Carmel Head eastward to Llanlana Head. This important locality in the fairway to Liverpool is studded with dangers and foul ground, and as ships navigate closer and closer every year it was deemed desirable to have the whole locality more minutely examined than was necessary when the former survey was made. The strength of the tides, and the rips they raise over rough bottom, prevent such a survey making more than slow progress, as it is impossible to sound with any accuracy except with a moderate stream. In spite of the monotony of such a survey and the positive danger to which the ship was constantly exposed, the whole ground was minutely examined, and while it would be rash to say that no more heads exist, Staff-Commander Archdeacon and his officers had the satisfaction of finding a new and isolated danger on which it seems somewhat extraordinary that no vessel has struck. This is a small rock, three and a-half miles eastward of the Skerries, and one and a-half miles from the land, with only 20 feet on it at low water springs, which lies very much in the track of ships using the channel between the Skerries and the shore. This danger was promptly buoyed by the Trinity House. Several shoal heads of  $4\frac{1}{2}$  fathoms were also discovered in the Skerries Channel, and owing to the great velocity of the tidal streams very dangerous rips were experienced, especially off Carmel Head, in the vicinity of which, during south-west gales, with the ebb tide, small deep-laden craft have been known to founder.

"*Nova Scotia (Halifax); Newfoundland, South Coast; Labrador (Belle Isle Strait).*—Staff-Commander W. Tooker and his staff were employed on the survey of the outer portion of Halifax Harbour, completing the coast line from Sandwich Point to Chebucto Head, and also soundings seaward to the Portuguese Shoal. The *Gulnare* left Halifax for the south coast of Newfoundland, and 10 days were spent in the vicinity locally known as Burgeo Bank, where an area of about 10 miles north and south by 15 east and west was closely sounded, but the least water found was 27 fathoms over a patch of small stones and shells

half a mile in extent. The soundings obtained proved that the western portion of this bank was more extensive than marked on the existing charts, the 50-fathoms contour line being eight miles farther to the south-west. Six weeks were afterwards spent in Belle Isle Strait, when the vessel returned to the south coast of Newfoundland, advantage was taken when in the vicinity of Rich Point to disprove the existence of two rocky shoals off that point, said to have two and three fathoms respectively over them. Depths of 40 to 90 fathoms were obtained around the reported positions, and no indications of shoal water were observed. These two shoals have been removed from the Admiralty charts. The soundings taken off Rich Point revealed a rocky bank about two cables in extent within the 10-fathoms line, with a least depth of seven fathoms lying one mile S. 70° W. (true) from the point.

“*Red Sea ; Seychelles ; Africa, East Coast.*—H.M.S. *Stork*, commanded by Lieutenant Smyth, surveyed in the southern part of the Red Sea, between Mohabbakah Islands and the Straits of Babel-Mandeb. This survey was undertaken with a view of ascertaining whether the route for steam-vessels passing west of Hanish Islands is safe for navigation. The peculiar difficulties of a survey in this region are that, except for a very brief period in every year, either the wind is so strong or the haze so thick as to make work impossible, or the heat is so great as to try the most zealous very severely. The non-existence of the shoal reported by the commander of the British steamship *Tagus* in 1869, to lie in 18° 1' N., 48° 1½' E., 2½ miles eastward of Scilla shoals, was proved. This would have been a serious addition to the dangers of this route, but Lieutenant Smyth's examination shows, that with ordinary care, this track may be safely followed in daylight, even in hazy weather.

“A bank of some extent, having 12 fathoms least water, was found 4½ miles northward of Balfe Point, Perim Island. The existence of this may, at times, prove of service to vessels when approaching that island from the north during thick weather, as the general depth around is over 20 fathoms.

“During September, the ship was actively engaged sounding over the rim of Seychelles Bank from Dennis Island to the westward and southward for 150 miles. The result of the preliminary lines of soundings confirm the supposition grounded on the few casts heretofore obtained, that there is a nearly continuous rim of more or less shallow water extending along the whole of the western part of this great bank, and show that caution inculcates that it should not be crossed north of 5° S. latitude. The great Seychelles bank is probably the largest submerged atoll in the world, having a perimeter of 500 miles.

“*Red Sea.*—H.M.S. *Rambler*, Commander L. S. Dawson, left Hong Kong on 14th February for England, via Suez Canal. It was, however, deemed necessary to detain her for some weeks in the southern part of the Red Sea to examine the projected route for vessels west of the

Hanish Islands, a task which was shared by the *Stork*, which worked south of the Mohabbakah Islands, while the *Rambler* took the northern side. The space embraced by the soundings covered an area of about 650 square miles, in which no new dangers were found. The *Rambler* was more especially directed to examine the edge of the bank which skirts the deep central gutter, as it is in such positions that small coral patches are not infrequently found. No indication was, however, discovered, but the area is so large and the difficulty of finding such rocks is so great that ships have been warned to keep in the deeper water of the centre of the sea.

"A search was also made for a patch of 16 fathoms charted to the southward of Jebel Teir and west of Zebayir Islands, in latitude  $15^{\circ} 12' N.$ , longitude  $41^{\circ} 44' E.$ , but the depths obtained over and near the spot averaged from 82 to 42 fathoms.

"*China, Borneo, Singapore.*—H.M.S. *Egeria*, under the command of Commander A. M. Field, proceeded direct to Vereker Bank, situated 45 miles north-westward of Pratas Island, China Sea, where a fortnight was spent in making a close examination of the locality, with a view to discover whether any small dangerous patch existed on this recently found bank. The *Egeria's* soundings, although failing to discover anything less on Vereker Bank than 85 fathoms, revealed the fact that a second but smaller bank existed three miles to the S.W., upon which a least depth of 92 fathoms was found, in latitude  $20^{\circ} 58' N.$ , longitude  $115^{\circ} 55' 30'' E.$  In the Sulu Sea, one day was devoted to an examination of the Pasig Shoal, and another day to sounding over and near the position upon which the Spanish schooner *Rosalía* was reported to have been lost in 1867. The search for Rosalia Reef was made under favourable circumstances of weather, without a trace of any irregularity in the bottom, over an area of 200 square miles, in depths between 1,100 and 1,200 fathoms. Memnon Bank, reported by the British steamship *Memnon* in 1889, was also sounded over and its limits defined. It was found within the 100-fathoms line to be about 3 miles long in an east and west direction, with a breadth of  $1\frac{1}{2}$  miles, rising from depths of 190 to 200 fathoms, having 8 fathoms least water; the bottom throughout being live coral with patches of sand.

"*Australia, North-West Coast.*—H.M.S. *Penguin*, Commander W. U. Moore, went to Bezout Island, near Cossack, and made a more detailed examination of the area of *magnetic disturbance*, situated two miles from Bezout Island. Briefly, the result of this further examination is as follows:—Within the limits defined of an area four miles long, N.E. and S.W., by two miles broad, with a depth of eight to nine fathoms at low water spring tides, the compass is disturbed from  $1^{\circ}$  at the outer limits to as much as  $56^{\circ}$  near the focus of the disturbing force. Over this focus the dip needle showed  $81^{\circ} 10' S.$ , the north-seeking end being thus repelled upwards  $81^{\circ}$ ; the greatest range in deflection of the *Penguin's* compass was  $86^{\circ}$ , viz.,  $56^{\circ}$  to the east and  $30^{\circ}$  to the west.

These magnetic observations by the *Penguin* corroborate the results of previous inquiry into local magnetic disturbance, viz., that in the southern hemisphere the north-seeking end of the needle is repelled by the disturbing force, while in the northern it is attracted. There is nothing, however, in the observations to lead to the opinion that any danger accrues to navigation in this locality except that a vessel steering by compass across the area of disturbance would be set out of her course, more or less, according whether she cut across it at the narrowest part or obliquely.

"The *Penguin*, when returning to Baudin Island from Roebuck Bay, defined Balein Bank and surveyed a small area to the west of it. This bank, whose position was hitherto doubtful, is situated 75 miles northward of Roebuck Bay, and lies in the direct track of vessels navigating this coast. Expedition Island placed on the chart of 1865, in lat.  $15^{\circ} 34' S.$ , long.  $129^{\circ} 45\frac{1}{2}' E.$ , on the authority of the master of the barque *Tien Tsin*, was found not to exist; the *Penguin* anchoring in 35 fathoms in the above position assigned to the centre of the island. Indications of a shoal were found three miles to the west and north-west of the position, but no land or sand-bank was visible from the topgallant-masthead at low water neap tide. Consequent on this search Expedition Island has been removed from the Admiralty charts.

"An unsuccessful search was made during three days, under favourable conditions of sea, for the reef supposed to be in lat.  $18^{\circ} 35' S.$ , long.  $125^{\circ} 19' E.$  An area extending about 10 miles around this position was sounded over, but no trace of shoal water was observed, the depths obtained were 80 to 45 fathoms over an even bottom consisting generally of coral sand, and shells. This reef has accordingly been expunged from the Admiralty charts. The general result of the *Penguin's* two years' survey of the maze of reefs, banks and channels north of Capes Voltaire and Bougainville is somewhat disappointing as regards the prospect of shortening the route between ports and ensuring safety. Some reefs placed on the charts by the first explorers had been cleared away. On the other hand, many new rocks and shoals have been discovered, which lie in the direct route of ships bound from Port Darwin or Wyndham to Derby or Roebuck Bay, by both the inner and outer routes. The water for 80 or 40 miles from the land is thickly impregnated with lime and mud, so that objects three feet below the surface are not visible. The *Penguin* has on two or three occasions narrowly escaped stranding on hitherto unknown rocks from this cause. The range of tide is large, 20 to 25 ft., and the tidal streams consequently strong. For these reasons the locality must always be navigated by large vessels with great caution, and it seems probable that the quickest and safest passages will be by making the long detour round the Holothuria Bank, at any rate, until beacons, buoys and lights are placed, which are at present out of the question.

"The locality, 180 miles northward of Port Darwin, where Captain Flinders in 1803 found a coral bank of seven fathoms, and also the

bank in the same vicinity, with 11 to 15 fathoms on it, discovered by Captain Blackwood, of H.M. ship *Fly*, were examined in close detail, with the result that four isolated banks (two being new) were found with from five to seven fathoms water over them, in the direct track of ships bound from Port Darwin to Hong Kong. These four banks appear to be but a portion of a submerged coral barrier.

“Water of a depth of over 2,000 fathoms was found over and around the position of the doubtful Bahia reef, Molucca Passage, which laid in the fairway of traffic between Amboina and Hong Kong. This bugbear to navigation has at length been erased from the Admiralty charts, with a fair certainty that it does not exist.

“*Queensland*.—The Colonial gunboat *Paluma*, under the command of Lieut. G. Pirie, visited Thursday Island for the purpose of searching for the reported sunken reef said to lie in the Prince of Wales Channel about five miles westward from Quoin Point, Goode Island. A careful examination of the assigned area failed to detect any indications of a reef. When returning to Cooktown the localities of five reported dangers—Pearn Reef, Erlangen Patch, Tannadice Shoal, Dugdale Rock, and a shoal  $5\frac{1}{2}$  miles north of Lizard Island, all near the track of steam-vessels using the inner route—were sounded over, but only the Erlangen Patch and Dugdale Rock were found. Their positions were accurately determined. From abreast of Chapman Island, near Cape Direction, the *Paluma* passed through a channel close inside the outer barrier reef to a point 16 miles north-westward of Cape Melville, in order to ascertain whether it would be safe, as an alternative and much shorter route, than that now followed along the coast. The result showed that detailed examination would first be necessary.

“*Tasmania; New Hebrides*.—H.M.S. *Dart*, commanded by Lieutenant G. C. Frederick, left Sydney for Tasmania. On the way a week was spent in Bass Strait, searching for a rock on which it was supposed the barque *Carlisle* had struck on the night of 6th August, 1890, to the southward of Moncœur Islands. A close search over the position given by the master of the *Carlisle*, and that which most nearly agreed with the reported bearings, failed to show any indication of shoal water, the bottom being very even and the soundings agreeing with those already on the chart. In all probability the *Carlisle* struck upon the well-known danger, Crocodile Rock. Proceeding to the New Hebrides, the survey was commenced of the islands between Efate and Api (including the south coast of Api) on a scale of one inch to the nautical mile. During the progress of this work no new dangers were discovered, but the incorrect positions of these islands, as shown on existing charts from old sketch surveys, proved the necessity of the work being undertaken in the interests of navigation.

“*India*.—The west shore of the Bay of Bengal was under survey, and a new plan of Coconada, one of the most important anchorages on that coast, was made. A re-survey of the Lakadive islands was commenced,

as some of the islands are reported to be erroneously placed on the chart to the extent of from three to six miles. A small plan, on a scale of three inches to a nautical mile, of Minikoi Island was made. The rock off Mirissi Point, south coast of Ceylon, on which the *City of Venice* was said to have struck, was not found; and the fishermen of the locality knew nothing of any danger near the assigned position. Deogarh harbour on the Konkan coast was surveyed, and large scale plans of Verawal and Jafarabad, on the Kathiawar coast, were executed.

"*Summary of the Publications of the Hydrographic Department in 1891.*—As regards *Charts*, 80 new charts and plans have been published, and 18 plates improved by 27 new plans; 59 worn plates have been partially re-engraved; 4,088 corrections have been made to plates by the engraver; 178 plates have been largely improved by corrections and additions; 81,089 charts have received minor corrections by the draughtsman; and the number of charts printed for official requirements and to meet the demands of the general public amounted to 287,198.

"There were published 644 *Notices to Mariners*, and seven *Hydrographic Notices*.

"Of *Books*, 26 volumes and pamphlets were published relating to sailing directions and other important hydrographical works, and 24 volumes and pamphlets were in progress."

## HONOURS NAUTICAL ASTRONOMY, 1892.



THE Nautical Astronomy paper placed before the candidates presenting themselves at the last May examination of the Science and Art Department was, as usual, well qualified to test the attainments of those concerned. It goes without saying that the sea is the only school for seamen; nevertheless, we understand that a very small percentage of the competitors in this important subject have had any nautical training. Shipmasters and deck officers nowadays require to be something more than riggers or boatswains, lest they sink into sorry insignificance; and it behoves them to keep pace with the educational movement, by availing themselves of the advantages afforded by the Science and Art Department in the subjects pertaining to a navigator's training. Passages have to be made now to the nearest second, and to this end an increased acquaintance with the theory and practice of Navigation and Nautical Astronomy is of the first importance. Old-time mariners, coasting carefully from headland to headland, were wont to